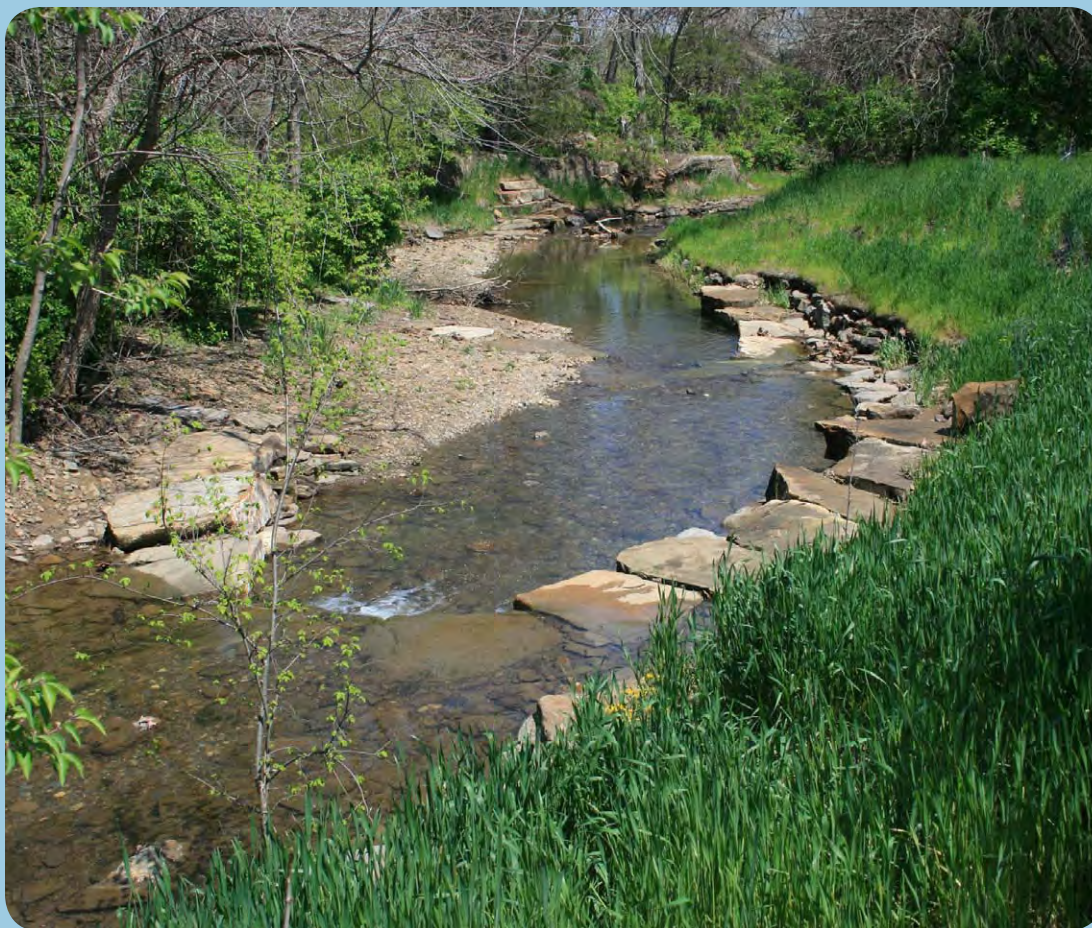


Streamside Protection Best Management Practices Manual



The citizen's guide to preserving and protecting our streams



Adopted on March 1, 2011 by Ordinance No. 11-5390

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Introduction

The City of Fayetteville adopted a Streamside Protection Ordinance to accomplish several goals:

- 1) **Reduce Pollutants in the Waterways:** Pollutants damage fragile ecosystems in our city's waterways and increase the costs of treating drinking water, which has a direct effect on water rates.
- 2) **Preserve Flood Capacity:** Healthy streambanks result in less flooding by providing greater infiltration capacity and slowing down stormwater that runs into the streams.
- 3) **Protect the Integrity of a Natural Resource:** Protecting the streambanks ensures greater recreational and nature enjoyment for current residents as well as future generations.

The ordinance establishes streamside protection zones along many of our City's streams and establishes protective requirements within those streamside buffers. This Best Management Practices (BMP) manual provides guidance for complying with the requirements adopted in the Streamside Protection Ordinance. A streamside buffer may also be called a riparian or forested buffer. It is the area along a stream that acts as a buffer between the waterway and activities that have a negative impact on the aquatic environment. These buffers protect natural habitats, reduce the potential for flooding and filter pollutants such as sediment, nutrients, bacteria, trash, emerging contaminants and vehicle pollutants.

Fayetteville is home to countless numbers of streams. The adopted ordinance affects streams that have at least 100 acres draining into that stream, which means it's typically a stream that runs year-round. However, this BMP manual can be used to protect smaller streams. Approximately 25 percent of the area affected by the ordinance is public property, often located in city parks and near trails. The rest of the area is owned by private property owners, which means that the entire community has a responsibility to ensure the protection of Fayetteville's waterways.

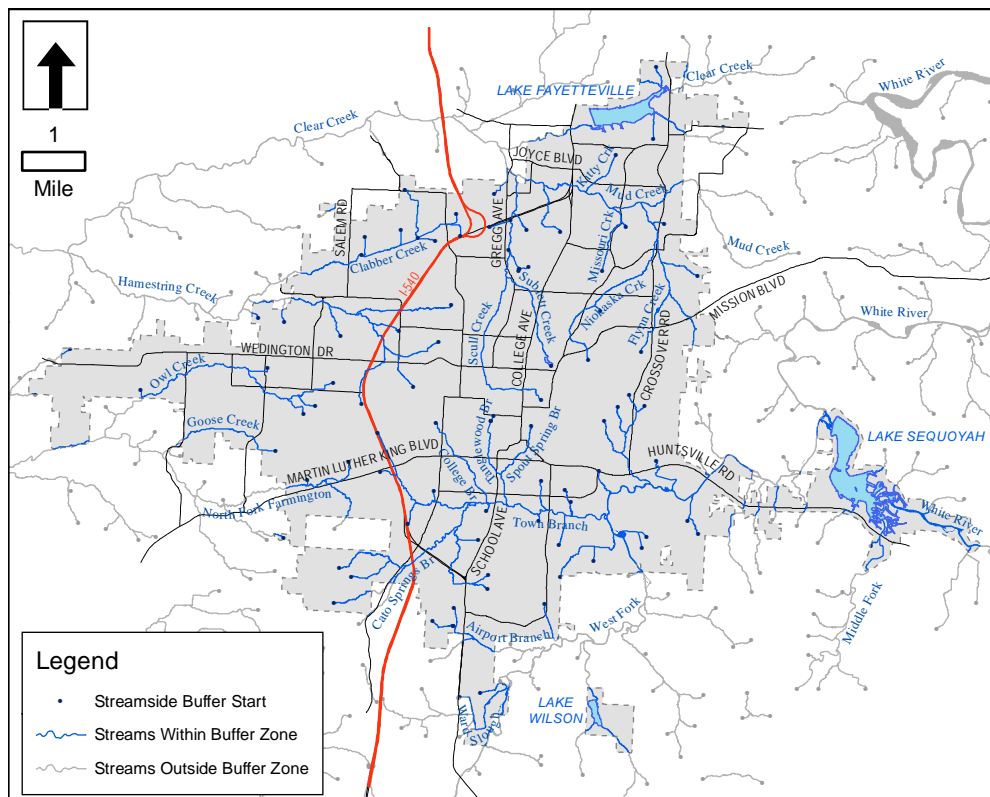
💧 **Benefits of a streamside buffer**

- Stabilize streambanks
- Filter sediment and the nutrients, pesticides, and pathogens bound to the sediment
- Protect groundwater and drinking water supplies
- Improve aquatic habitat
- Improve wildlife habitat
- Provide visual interest
- Protect against flooding
- Provide shade

Streams identified on the Streamside Protection Map will have at least a 50-foot buffer applied from the top of bank. Visit www.accessfayetteville.org or the Development Services office to view the Streamside Protection Map. If your property contains or borders a buffer zone, the extent of the buffer should be measured from the stream's top of bank, as follows: 1) Waterside Zone – 25 feet from top of bank, and an additional 20 feet if the slope exceeds 15%*; and 2) Management Zone – 25 feet from edge of Waterside Zone or to the edge of the FEMA floodway, whichever is greater.

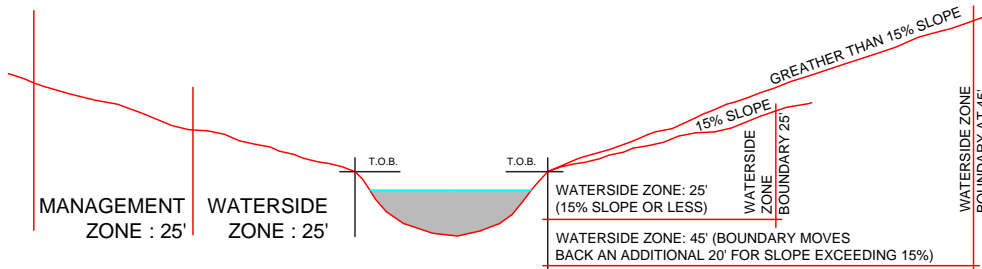
*[Slope shall be calculated at the upstream and downstream property lines for every property. Properties that exceed 100 feet in width shall require additional slope calculations at 100 foot increments.]

Protected Streams



Streamside Zones: Cross section

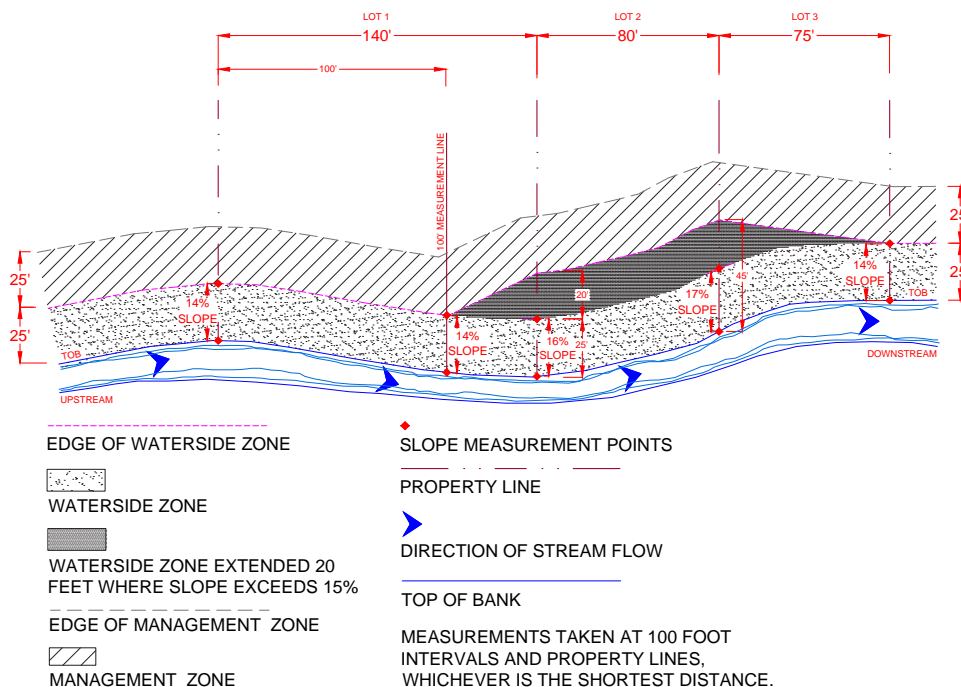
THE WATERSIDE ZONE EXTENDS 25 FEET FROM TOP OF BANK (T.O.B.) WHEN THE SLOPE IS LESS THAN 15%. THE BOUNDARY MOVES BACK AN ADDITIONAL 20 FEET FROM THE T.O.B. FOR SLOPE THAT EXCEEDS 15%. DRAWING NOT TO SCALE.



STREAMSIDE ZONE BOUNDARIES WITH 15% SLOPE OR LESS

WATERSIDE ZONE BOUNDARIES WITH SLOPE GREATER THAN 15%

Streamside Zones: Slope Diagram (Aerial View)



“Top of Bank” is the point along a streambank where an abrupt change in slope is evident, and where the stream is generally able to overflow the banks and enter the adjacent floodplain during flows at or exceeding the average annual high water stage.

Ordinance Requirements for Property Maintenance

The goal of buffer management is to develop a self-sustainable, variable-aged stand of mixed trees, shrubs and groundcover with a floor of either leaf litter and debris, or mulch. Dense, vigorous vegetation protects the soil from raindrop impact, a major force in dislodging soil particles and moving them down slope. The shielding effect of a plant canopy is augmented by roots that hold the soil, improve its physical condition, and increase the rate of infiltration. Plants also reduce the moisture content of soil through their uptake of water and transpiration, the process by which moisture escapes through their leaves and stems, thus increasing the soil's capacity to absorb water. Large trees and carefully designed buffers may dramatically increase property value. Once established, vegetated buffers do not require maintenance beyond the routine procedures and periodic inspections.

LAWN AND GARDEN CARE

Ordinance requirements:

- Managing your lawn, and garden, is permitted within the streamside protection zones; however, the best care of a buffer area is a hands-off approach. In the Waterside Zone, the best management practices are required; in the Management Zone, the best management practices are encouraged.
- New lawns and gardens may only be created within the buffer area if the lawn would not replace woody vegetation. Many properties have existing lawns and gardens that already extended into the buffer prior to the establishment of the streamside buffer and are grandfathered in under this ordinance.
- Some City parks are included in the properties that have existing lawns within the buffer area. Some of these lawns have playgrounds or other recreational uses, which will continue to require that the lawns be mowed more frequently than several times a year for reasons of public safety.

◆ Mowing twice during the season is usually enough. Mow just before annual weeds produce seeds to keep the seed from maturing.

◆ Soil testing is available free of charge. Contact the Washington County Extension Office at (479) 444-1755.



vegetated stream

◆ Maintained lawns, while better than bare soil, do not provide all of the required buffer functions and may actually contribute to nonpoint source pollution through the application of fertilizers and pesticides associated with maintaining a lawn.

Why are lawns and gardens discouraged in the streamside protection zone?

Manicured lawns do not perform important buffer functions like preventing erosion and slowing water run-off. The root systems of manicured lawns are not deep enough or strong enough to prevent stream banks from eroding, which can lead to loss of property. In addition, lawns typically are not tall enough to adequately slow down water as it runs into the creek, preventing filtration and causing water surges during storm events. Additionally, manicured lawns and gardens will often require the application of fertilizers, herbicides and pesticides, which increases the likelihood that these pollutants will enter the water system.

Leaves and grass clippings naturally contain nutrients such as phosphorus and nitrogen, which means that these pollutants can enter the waterways when leaves and grass clippings are swept into the buffer areas. Leaves and grass can also clog storm sewers and drainage swales and contribute to localized flooding.

The nutrients that create fertile soil for gardening also foster algae growth in waterways. When possible, property owners should locate gardens and compost piles outside of the streamside protection zones.

What do I do?

Property owners can help protect streams by employing the following best practices:

Lawn and Garden Management Practices:

- ▶ Limit treatment with herbicides, pesticides or fertilizers.
- ▶ Mow on the highest setting on your lawn mower.
- ▶ Reduce the frequency with which you mow to only several times a year within the buffer area, provided the property does not become unsightly or unsanitary as outlined in Chapter 95 of the Fayetteville City Code.
- ▶ Dispose of leaves and grass clippings outside of the



grass clippings and leaf debris

- ▶ Lawn care consumes more herbicides per acre than most farmers broadcast to grow crops.

- *UA Community Design
Center Low Impact
Development Design
Manual*

streamside protection zones.

- ▶ Make sure leaves and grass clippings are not raked to or disposed of in the street or other water flow routes where the nutrients they contain can be washed into streams.
- ▶ Sweep clippings and leaves off paved surfaces and onto lawns.
- ▶ When possible, property owners should locate gardens and compost piles outside of the streamside protection zones.
- ▶ Position garden rows parallel to the stream to reduce potential sediment and nutrient run-off.
- ▶ Establish a small buffer around the garden to reduce potential sediment and nutrient run-off.

Other Alternatives:

- ▶ Convert such lawn areas to woody vegetation or native grasses that are not mowed.
- ▶ If you would like to have access or a view of the stream, then you could create a small area of low growing vegetation that will preserve the buffer and the wildlife corridor.

- ▶ Fayetteville offers a weekly curbside Yard Waste Service to city residents as an environmentally conscious means for disposing of yard waste. The City collects yard waste in the form of grass, leaves and brush. The City encourages participation in some form of yard waste reuse, whether it is the Yard Waste Service, backyard composting, or the use of a mulching lawn mower.

PESTICIDE AND FERTILIZER APPLICATION

Ordinance requirements:

- Fertilizers and pesticides may be permitted when applied in conformance with the following standards.
- Storage of hazardous materials or chemicals in the streamside protection zone is prohibited unless stored in waterproof containers in a garage or shed protected from precipitation.

In the Waterside Zone, the best management practices are required; in the Management Zone, the best management practices are encouraged.

Why is the use of chemicals on the lawn discouraged?

Chemicals contaminate the water supply. Chemical treatment may be required to counter the tenacity of invasive species or insects, but because of dangers of unintended damage to the underlying native vegetation or “good” insects, chemical use should be the choice of last or extreme resort.

What do I do?

- ▶ Use in the streamside protection zones should be limited and approved for use adjacent to a water body.
- ▶ Pesticides should be applied directly to the roots, bark, leaves and/or stumps using devices such as a hand sprayer, foam brush, wand or hypo-hatchet.
- ▶ Applications should occur at least two days prior to a rain event.
- ▶ Consult with a knowledgeable source such as a county extension agent to assure use of the appropriate chemical at the correct rate.
- ▶ Adhere to the manufacturer’s recommendations to ensure the safety of nearby surface waters.
- ▶ Complete a soils analysis to identify the property type and quantity of fertilizer needed. Soil test kits can be obtained through the Washington County Extension Office.

☛ Fayetteville offers a weekly curbside Yard Waste Service to city residents as an environmentally conscious means for disposing of yard waste. The City collects yard waste in the form of grass, leaves and brush. The City encourages participation in some form of yard waste reuse, whether it is the Yard Waste Service, backyard composting, or the use of a mulching lawn mower.



chemicals



the application of lawn fertilizer

- ▶ Store all chemicals in waterproof containers in a garage or shed protected from precipitation.
- ▶ Buy only what you need to reduce the need to store leftovers.

REMOVING VEGETATION

Ordinance requirements:

- The removal of non-invasive living trees and woody vegetation is prohibited in the streamside protection zone, unless the removal is needed to maintain drainage capacity in the stream channel. In addition, removing dead vegetation, invasive species, and pruning is allowed. In the Waterside Zone, the best management practices are required; in the Management Zone, the best management practices are encouraged.

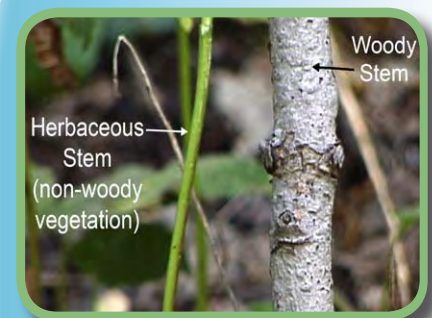
When should I remove vegetation?

In a natural setting, dead and dying trees are a natural part of forest succession. Dead standing trees and logs on the ground provide food and shelter to many organisms and provide nutrients to the young forest vegetation as it grows and should not be removed unless they threaten to undermine the integrity of the stream bank or create flooding hazards. Naturally occurring leaf litter, twigs, and branches are an essential part of the buffer, functioning to retard run-off and return nutrients to the soil. Snags, or dead standing trees, offer nesting and perching sites for many wildlife and bird species. However, trees that are diseased or infested may have to be removed if the disease or insects threaten other trees and other control methods, such as chemical application, are likely to damage the adjacent waterway.

Minimal pruning should be required because trees will self-prune as lower branches get shaded out. Trees grow most efficiently when there is enough canopy to provide plenty of food for the tree. Overzealous pruning can result in the loss of food production so that trees become stunted and may take time to regain optimum growth rates.

Removal of vegetation should also be considered when invasive

- ◆ What is woody vegetation? Woody vegetation includes noninvasive trees and shrubs or vines with hard, thick stems. One way to tell if shrubs or vines could be classified as woody vegetation is to see if they have bark on their stems.



woody and non-woody vegetation



woody and non-woody vegetation near stream



streamside clearing

species threaten to over-run or out-compete native trees and shrubs. Control of non-native, exotic species, or even invasive native species, may be justified when this happens.

What do I do?

- ▶ Leave stumps and roots in place to help bind the soil, if they are not a danger to life or property. Leaving an otherwise healthy stump can encourage new growth and regeneration.
- ▶ Contact a certified arborist if a tree is diseased or infested and threatens other trees in the vicinity. A list of tree pruners/ tree services certified by the City of Fayetteville is available at accessfayetteville.org.
- ▶ Prune trees during late fall, winter, or early spring while the plants are dormant. Pruning while the tree is dormant helps reduce problems with losing food production while actively growing and decreases the risk of infection.
- ▶ When pruning trees and shrubs:
 - Correct multiple leaders as soon as possible.
 - Leave side branches until they are 1 inch in diameter, but remove before they become 3 inches in diameter.
 - Never cut out more than 25% of the crown of a tree.
 - Retain at least 2/3 of the tree height in live branches to protect tree health.



bird nesting in a snag

IN-STREAM MAINTENANCE ACTIVITIES

Ordinance Requirements

- Maintenance of drainage capacity in the channel may be permitted including tree and sediment removal. The best management practices are required because the channel is in the waterside zone.

Why should caution be exercised when removing sediment?

Streams are complex natural systems. Gravel bars are natural components of some stream types and some locations are naturally subject to sediment deposition.

When sediment is removed from a stream channel, further deepening of the channel as well as bank erosion often occurs. This could lead to property damage or loss during high flow events. Sediment removal at one stream location can also lead to bank failure and property loss at upstream locations as well. Downstream of where the sediment has been removed, all the newly eroded sediment collects. This restricts the channel flow, often causing extreme widening of the channel. This sediment deposition can result in property damage or loss during flood events for downstream neighbors.

Why should caution be exercised when removing trees within the channel?

Many healthy trees lean over to catch sunlight and remain that way for many years. Determination of tree removal should consider a variety of factors, including the tree's overall condition, its potential for falling, and the amount of undercutting it may be causing.

What Do I Do?

- Restore the channel to a width and depth consistent with the width and depth observed at a more stable channel location



widened channel and property loss resulting from improper sediment removal

- ◆ Sediment in the stream and banks may range in size from silt and sand to gravel, cobbles and boulders.



tree over channel

in cases where there has been a significant change in the flow area of the channel.

- ▶ Remove blockages such as large trees or debris that are underneath or against a bridge or culvert to maintain or protect approaches to stream crossing structures.
- ▶ Leave stumps unless the stump is obstructing flow in a harmful way. If possible cut the stump flush with the existing ground. If stump is removed back fill the hole with soil or rock to stabilize and revegetate the disturbed area.
- ▶ Do not remove large rock and boulders from a stream. Gravel bars, rocks and boulders all help reduce flood power, keep a stream stable and provide valuable aquatic habitat.
- ▶ Do not place loose gravel and material on stream banks or build up artificial barriers, debris piles or levees. This will prevent the stream from spreading out on the floodplain and will increase water velocities and associated flooding downstream.
- ▶ Contact state or federal resource agencies about obtaining the required permits for in-stream activities.
- ▶ The Corps of Engineers can provide guidelines for responsible methods of sediment removal including how heavy equipment may be used. Heavy equipment in the stream such as bulldozers should not be used in the creek without proper permits and approvals.
- ▶ A Corps of Engineers permit is required when more than 25 cubic yards of fill material will be used below the “ordinary high water mark” (the approximate yearly flood level). US Army Corps of Engineers, Beaver Lake Project Office, (479) 636-1210 or ceswl-by@usace.army.mil
- ▶ Arkansas Department of Environmental Quality may require a permit called a Short Term Activity Authorization for stream activity with the potential to create a water quality standards violation such as turbidity. Arkansas Department of Environmental Quality, (501) 682-0645 or <http://www.adeq.state.ar.us/>



rocks provide stream stabilization and natural aquatic habitat

- ◆ Don't remove gravel where deepening of the channel is the primary cause of the instability, as gravel extraction will only accelerate the problem.



dredging of stream channel

ADDITIONAL RESOURCES

- ▶ Washington County Cooperative Extension Office and U of A plants database
<http://www.arhomeandgarden.org/landscaping.htm>
479-444-1755
- ▶ USDA Plant Database
<http://plants.usda.gov/>
- ▶ “Go Native When You Go Green!”
<http://www.fayettevillenatural.org/userfiles/file/Northwest%20Ark%20Trees%20and%20Shrubs.pdf>
- ▶ City of Fayetteville Tree and Landscape Manual
Listed on the City Parks and Recreation website under “Urban Forestry”
http://www.accessfayetteville.org/government/parks_and_recreation/documents/
- ▶ University of Florida & USFS Northern Tree Database
<http://lyra.ifas.ufl.edu/NorthernTrees/>
- ▶ University of Florida Landscape Plants Database
<http://hort.ifas.ufl.edu/woody/>
- ▶ National Invasive Species Information Center
<http://www.invasivespeciesinfo.gov/unitedstates/ar.shtml>

Helpful Information for Property Maintenance

SOIL EROSION

What's wrong with bare soil?

The Environmental Protection Agency lists sediment as the most common pollutant in rivers, streams, lakes and reservoirs, causing \$16 billion in environmental damage annually. Area waterways, such as the West Fork of the White River, are listed as impaired for sediment. Sediment entering waterways degrades the quality of drinking water, wildlife and the land surrounding streams in several ways:

- Sediment fills up storm drains and catch basins that carry water away from roads and homes, which increases the potential for flooding.
- Sediment in stream beds destroys habitats for the smallest organisms and causes massive declines in fish populations.
- Sediment increases the cost of treating drinking water and can result in odor and taste problems.
- Sediment particles carry other pollutants such as phosphorus, pathogens and heavy metals.

What do I do?

- ▶ Inspect areas for bare soil after heavy rainfall. Focus on gully erosion, the density of the vegetation, evidence of concentrated water flow through the areas, and any damage from foot or vehicular traffic.
- ▶ Plant ground cover vegetation or use wood-chip mulch or landscape fabric.
- ▶ On steep slopes, plant a vigorous ground cover and avoid turf grass that requires mowing.



flood waters and streambank erosion



eroded streambank



streambank restoration using landscape fabric

REVEGETATION: WHAT TO PLANT

Why are plants, and native plants in particular, important in the streamside protection zone?

The vegetation planted in the streamside protection zone greatly influences the effectiveness of the buffer. The vegetation's root systems and density will significantly affect how well the streambank is protected. Property owners should be aware of the distinction between noxious weeds or invasive species and native plants. For the purpose of this manual, "noxious weed" encompasses any invasive species that has gotten out of control and has become harmful to the health and survival of the woody vegetation in the buffer. Invasive plants disrupt natural habitats by choking out native plants, altering the local ecology and potentially threatening local animal species.

If an invasive species is performing a desirable function such as preventing erosion on a bank, it should not be removed without replacing it with vegetation of at least equal value for erosion control and water quality functions. Some common noxious species are Japanese honeysuckle, kudzu, mile-a-minute, multi-flora rose, English ivy, all privets, and winged euonymus.

What do I do?

- ▶ Plant native plants, which are already adapted to the area and generally withstand local weather and soil conditions. They often require less ongoing maintenance, including watering. Native plants are naturally resistant to insect pests and diseases and by planting them not only are you helping prevent the establishment and spread of invasive non-native plants, but also protecting the local ecology.
- ▶ Replant in such a way that minimizes disturbance to the root systems of existing vegetation.
- ▶ Avoid planting invasive species.

💧 Invasive Species tend to spread uncontrollably, overwhelming other, especially native, species; some native species may qualify as an invasive.



japanese honeysuckle



kudzu



mile-a-minute vine

💧 Common invasive species: Japanese honeysuckle, kudzu, mile-a-minute, multi-flora rose, English ivy, all privets, and winged euonymus

Examples of species suitable for planting in riparian buffers.

| | |
|---|---|
| Flood Tolerant Trees | |
| Bald Cypress <i>Taxodium distichum</i> | Black Willow <i>Salix nigra</i> |
| Overcup Oak <i>Quercus lyrata</i> | Water Tupelo <i>Nyssa aquatica</i> |
| Swamp Tupelo <i>Nyssa sylvatica</i> var. <i>biflora</i> | |
| Moderately Flood Tolerant Trees | |
| Sycamore <i>Platanus occidentalis</i> | Sugarberry <i>Celtis laevigata</i> |
| Eastern Cottonwood <i>Populus deltoides</i> | American Elm <i>Ulmus americana</i> |
| Green Ash <i>Fraxinus pennsylvanica</i> | Water Oak <i>Quercus nigra</i> |
| River Birch <i>Betula nigra</i> | Willow Oak <i>Quercus phellos</i> |
| Swamp Chestnut Oak <i>Quercus michauxii</i> | Nutall Oak <i>Quercus nuttallii</i> |
| Flood Intolerant Trees | |
| Black Walnut <i>Juglans nigra</i> | Shortleaf Pine <i>Pinus echinata</i> |
| Persimmon <i>Diospyros virginiana</i> | White Ash <i>Fraxinus americana</i> |
| White Oak <i>Quercus alba</i> | Sweet Pecan <i>Carya illinoensis</i> |
| Blackgum <i>Nyssa sylvatica</i> | Cherrybark Oak <i>Quercus pagoda</i> |
| Small Trees | |
| Redbud <i>Cercis canadensis</i> | Fragrant Sumac <i>Styrax obassia</i> |
| American Plum <i>Prunus americana</i> | Crabapple <i>Malus</i> spp. |
| Serviceberry <i>Amelanchier canadensis</i> | Flowering Dogwood <i>Cornus florida</i> |
| Shrubs | |
| Roughleaf Dogwood <i>Cornus drummondii</i> | Shrub Willow <i>Salix</i> spp. |
| Elderberry <i>Sambucus nigra</i> | Beautyberry <i>Callicarpa americana</i> |
| Grasses | |
| Indiangrass <i>Sorghastrum nutans</i> | Big Bluestem <i>Andropogon gerardii</i> |
| Little Bluestem <i>Schizachyrium scoparium</i> | Switchgrass <i>Panicum virgatum</i> |



sycamore



black willow



eastern redbud



indiagrass

ANIMAL AND PET WASTE

Does pet waste really affect our streams?

The EPA has placed pet waste in the same category of nonpoint source pollution as oil and toxic chemicals. It is considered a major pollutant and contaminant of water supplies and is one of the most common sources of nutrient load in waterways. Pet waste in lakes and streams can use up and lower oxygen levels, killing fish. Nutrients from the waste can encourage weed and algae growth, which is harmful to a healthy balance in an aquatic system.

What do I do?

- ▶ Kennels are prohibited within the streamside protection zone and should be located away from any drainage paths leading to the stream. Kennels as defined in the Unified Development Code are structures or facilities used for the purpose of breeding two or more litters within a 12-month period or a facility that keeps animals commercially and has open dog runs.
- ▶ Pet waste should be picked up regularly and disposed of in the trash.
- ▶ While fowl would typically be considered livestock, the City of Fayetteville does allow single-family residences to keep up to four hens in a fenced enclosure. (See §164.04 of the Unified Development Code.). Just like other pets, these hens would be allowed, but the coop/roost area should be located outside the Waterside Zone when possible.



pet waste bag dispenser

Ordinance Requirements for Development and Construction

STREAMSIDE PROTECTION MEASURES AND CONSTRUCTION

Ordinance Requirements

- Prior to any land clearing or soil disturbing activity, the Streamside Protection Zones (SPZ) boundaries shall be clearly delineated on site by the applicant, and such delineation shall be maintained throughout construction activities.
- A site inspection followed by periodic inspections during construction will be conducted by the City Engineer or designated representative to ensure compliance with the Streamside Protection Zones ordinance.
- Streamside protection zones shall be protected from construction activity. To prevent negative impacts, construction vehicle access is prohibited in the SPZ except at permitted crossings.
- Storage of construction vehicles, materials, debris, spoils or equipment is prohibited in the SPZ.
- Before commencing any construction activity, the applicant shall install silt fencing on the site at the outer edge of the SPZ, or as directed by the City Engineer. The City Engineer may require other protective measures based upon the individual characteristics of the site and the proposed construction methods.
- If the required barriers surrounding the SPZ are not adequately maintained during construction, the City Engineer shall prescribe remedial measures, and may issue a stop work order in accordance with §153.07.
- All remedial measures shall be completed within the specified amount of time and shall be considered prior to granting future inspections from any other city division, final plat approval or issuing a certificate of occupancy.
- The City Engineer may require other protective measures based upon the individual characteristics of the site and the proposed construction methods.

Construction activities can be particularly damaging to the streamside zone. Some results of construction disturbances in the streamside zone are permanent loss of vegetation, permanent loss of water infiltration due to soil compaction, alteration of natural water runoff patterns, and an avenue for noxious weeds to establish themselves.



silt fence along construction zone



soil compaction during construction

Soil compaction by heavy equipment can reduce water intake of soils to 5 percent or less of the original rate.

STREAM CROSSINGS FOR TRANSPORTATION

Ordinance requirements:

- Stream crossings, including driveways, roadways, trails, or railroads, are allowed when the City Engineer determines there is no practical and feasible alternative.

Minimizing Stream Crossing Impacts

Consideration of the following elements will aid in reducing the impact of stream crossings:

- ▶ Minimize or reduce stream crossings through proper planning.
- ▶ Minimize the amount of excavation and filling.
- ▶ Maintain the dimension, pattern, and profile of the stream.
- ▶ Minimize scour, erosion, and flooding.

Methods to minimize stream crossing impacts:

- ▶ Construct stream crossings during periods of low flow.
- ▶ Locate crossings where streambed and banks are composed of firm, cohesive soils to minimize erosion.
- ▶ Design crossings to reduce the possibility of obstructions such as debris and silt blockages through the minimization of channel obstructions.
- ▶ Bridges and bottomless arches, wide enough to span the stream and allow for some dry ground or an artificial ledge beneath the bridge on one or both sides are preferred and should be used whenever possible.
- ▶ Bridge soffits should be a minimum of one foot above the height of adjacent banks--high enough to allow wildlife passage.
- ▶ Exceptionally wide stream crossings may be allowed to utilize piers in the channel under the discretion of the City Engineer.



streamside low impact bridge



clear span trail bridge

- ▶ Maintain a natural substrate underneath the bridge. If concrete is necessary to prevent scour, then it is recommended to cover the concrete with a natural substrate.
- ▶ All disturbed areas shall be revegetated immediately upon completion of the work
- ▶ **The use of culverts should be avoided.** If culverts must be used, the following installation guidelines should be followed:
 - Provide water depths and velocities (at low flows) matching natural areas upstream and downstream of the crossing.
 - Create no drop-offs or plunge pools and no constriction of the channel.

The practices listed may be subject to additional regulation per UDC Chapter 168 Flood Damage Prevention Code, Chapter 169 Physical Alteration of Land, and Chapter 170 Stormwater Management, Drainage and Erosion Control.



drainage riprap along streamside

UTILITIES

Ordinance requirements:

- Maintenance and upgrades of existing utility facilities are allowed in the Waterside Zone if BMPs are followed. BMPs are encouraged in the Management Zone.
- Installation of new utility facilities are allowed in the Management Zone, and may be allowed in the Waterside Zone if the City Engineer determines there is no practical and feasible alternative. This requirement also applies to the installation of facilities in the waterway itself.

Maintenance, Upgrades and Installation of New Utilities:

- ▶ The width of the easement shall be limited to the minimum width necessary for the utility's installation and maintenance.
- ▶ Once started, carry out and complete construction without delay. Leaving construction work incomplete increases risk of erosion and sediment transport.
- ▶ Where clearing is required, limit or delay grubbing until grading and construction is ready to proceed; the root masses and associated organic matter provide substantial erosion control.
 - Clearing ahead of the point of construction may not exceed 500 feet.
 - Except for clearing, the maximum length of disturbed work area, including grubbing, shall not exceed 300 feet before temporary stabilization is made with, at a minimum, seed and mulch.
 - Permanent soil stabilization with perennial vegetation or other permanently stable, non-eroding surface shall be initiated within 14 days after final site grading.
 - Implement erosion and sediment controls that meet or exceed the requirements set forth in UDC Chapter 169 and 179 and the Arkansas Department of Environmental Quality.



clearly labeled utility



minimized utility easement work width



sediment filter used during construction



native plants used for final stabilization

- ▶ Access maintenance routes shall be limited to 20 feet in width and, where possible, shall approach manholes, risers, valves, or other appurtenances perpendicular to the stream rather than running the length of the utility line to minimize post installation clearing in the buffer.
- ▶ Leave stumps and roots in place when trees are cleared to help bind the soil, if they are not a danger to life or property.
- ▶ Prepare and maintain on site a Stormwater Pollution Prevention Plan (SWPPP) for construction sites over one acre. (Required by the Arkansas Department of Environmental Quality)
- ▶ File a Notice of Intent with the Arkansas Department of Environmental Quality for construction sites over five acres. (Required by the Arkansas Department of Environmental Quality)
- ▶ Sediment and erosion controls shall be installed prior to any surface disturbance activity, such as clearing or grubbing.

Installation of Utility Stream Crossings:

- ▶ Crossings shall be contained within the footprint of an existing road or utility crossing where possible.
- ▶ Stream bank stabilization to protect new structures from future channel migration shall be accomplished through vegetative or flexible linings. The utility installation shall not increase or decrease the natural rate of channel migration.
- ▶ For above grade utility crossings, pier locations shall be planned to minimize or avoid placement in the stream.
- ▶ Below grade utility crossings:
 - The installation shall be accomplished by directional boring or jacking beneath the scour depth of the water body and channel migration zone, where feasible.
 - Where directional boring or jacking are not feasible, detailed plans showing how flow will be diverted away from the area during construction (use of coffer dams, temporary culverts, etc.) and how the channel will be rehabilitated to its pre-alteration state following installation of the utility are required
 - Utilities shall cross at an angle perpendicular to the channel centerline, or as near to perpendicular as



above grade piers outside of stream

possible, whenever boring under the channel is not feasible.

- Below grade utilities shall be encased in steel, to minimize maintenance needs, and buried to a depth sufficient so as not to alter the flow of the stream, catch debris, or cause erosion or deposition.

PAVED TRAILS AND IMPERVIOUS SURFACES

Ordinance requirements:

- Paved trails or other impervious surfaces not exceeding 12 feet in width are permitted in the Waterside Zone when the City Engineer determines that there is no practical and feasible alternative.

Trails, like any impervious surface, prevent infiltration and require the removal of vegetation, which can compromise the bank's stability. However, the trails system also offers multiple benefits to riparian areas:

- By creating a place for public enjoyment along the stream, the trail brings people in contact with the stream to appreciate the natural beauty and report dumping or other detrimental activities.
- The Adopt-A-Trail program has been very successful at attracting volunteers to pick up litter along the trails and stream corridors.
- The trail provides educational opportunities along the stream by providing easy access to the unique and diverse riparian corridor. Children can come in direct contact with the streams and grow a stronger appreciation for the natural systems.
- The trail provides access for equipment to remove large debris or trash and repair impaired areas of the stream to prevent future stream bank erosion through naturalized repair methods.

The following best management practices are required in the Waterside Zone and encouraged in the Management Zone:

- ▶ Locate trail as far from the “top of bank” as practicable.
- ▶ The existing vegetated buffer between trail and “top of bank” shall be maintained to the extent practical to protect significant trees and sensitive areas such as stream edges or springs.
- ▶ Once started, carry out and complete construction without



stream cleanup volunteers



illegal streamside dumping

delay. Leaving construction works incomplete increases risk of erosion and sediment transport.

- ▶ Where clearing is required, limit or delay grubbing until grading and construction is ready to proceed; the root masses and associated organic matter provide substantial erosion control.
 - Clearing ahead of the point of construction may not exceed 500 feet.
 - Except for clearing, the maximum length of disturbed work area, including grubbing, shall not exceed 300 feet before temporary stabilization is made with, at a minimum, seed and mulch.
- ▶ Final stabilization shall be done using native plants to match or exceed the quality of vegetation existing prior to trail.
- ▶ Implement erosion and sediment controls that meet or exceed the requirements set forth in UDC Chapter 169 and 179 and the Arkansas Department of Environmental Quality.
- ▶ If a utility easement is established, and has been previously cleared and disturbed, the impervious surface shall be located on the utility easement to minimize the overall amount of disturbance.
- ▶ Concrete shall be required, in flood prone areas, because it has a greater resistance to flooding conditions than asphalt, requiring less repair and overall land disturbance.
- ▶ If there is an exposed cut bank or highly eroded stream bank on the same property as the impervious surface being constructed, the bank shall be stabilized using natural channel design methods at the time of trail construction. All bank stabilization shall receive approval from the City Engineer, prior to land disturbance activities.
- ▶ Sheet flow drainage conditions from the impervious surface and its appurtenances are required. Where flow is concentrated, the methods in the flow diffusion section of this manual shall be used.
- ▶ Turf grass is allowed 5 feet from the edge of the impervious surface to allow for periodic mowing. Beyond 5 feet from the edge of the impervious surface, native plants shall be used where revegetation is necessary.



minimalized trail construction footprint



existing utility easement and site of future trail



5' turf grass buffer along trail

STORMWATER OUTFALLS

Existing stormwater conveyances on site or accessible to the site are the preferred location to direct stormwater runoff from the site. Existing conveyances utilized for additional stormwater flows shall be modified in conformance with best management practices for new facilities.

Ordinance requirements:

- New stormwater conveyances where no conveyances exist or are accessible to the site may be permitted in the SPZ when the City Engineer determines there is no practical and feasible alternative. The standards in the Streamside Best Management Practices Manual are required for both the Waterside and Management Zones.

Minimizing Stormwater Outfall Impacts:

All of the following Best Management Practices shall apply to new stormwater conveyances through the SPZ:

- ▶ Minimize sediment loads and trash prior to entrance into the SPZ through practices such as:
 - Stilling Basin
 - Outlet Sediment Traps
 - Grass Swales
 - Check Dams
 - Bioretention Cells
 - Enhanced Detention Pond (See on page 29)
 - * Prevent Short Flow Paths
 - * Extended Dry Detention
 - * Retention Ponds/Wet Ponds
 - * Sediment Forebays
 - * Meandering Low Flow Channels
 - * Micropools
 - * Marshes
 - * Plunge Pools
 - * Pond Buffers (25 feet minimum)
 - * Rip-rap pilot channels

- ▶ Design for a minimum number of discharge locations to the stream and choose an alignment through the SPZ which will result in minimal clearing of existing vegetation.
- ▶ Design for minimal amounts excavation and no filling in the SPZ.
- ▶ Convert flow to a velocity that is non-erosive at the 10-year design storm before the flow enters the stream. Possible practices to achieve velocity reduction include:
 - RipRap Aprons
 - Level Spreaders
 - Check Dams
 - Outlet Sediment Traps
- ▶ Angle the discharge into the direction of flow of the receiving water to provide a more natural confluence if possible.
- ▶ Design to minimize the long-term impact in the SPZ and the receiving stream.
- ▶ Implement erosion and sediment controls that meet or exceed the requirements set forth in UDC Chapter 169 and 170 and the Arkansas Department of Environmental Quality.
- ▶ Discharges must be managed during construction as well and may use an approved temporary method different from the permanent post-construction method used.
- ▶ Once construction is started, carry out and complete project without delay.
- ▶ Design in accordance with and obtain all required local, state, and federal permits.
- ▶ Design in accordance with the City's *Drainage Criteria Manual*.
- ▶ Periodic corrective action to restore a non-erosive velocity of flow or to restore stability of the conveyance shall be taken as necessary to impede the formation of erosion gullies.



level spreader

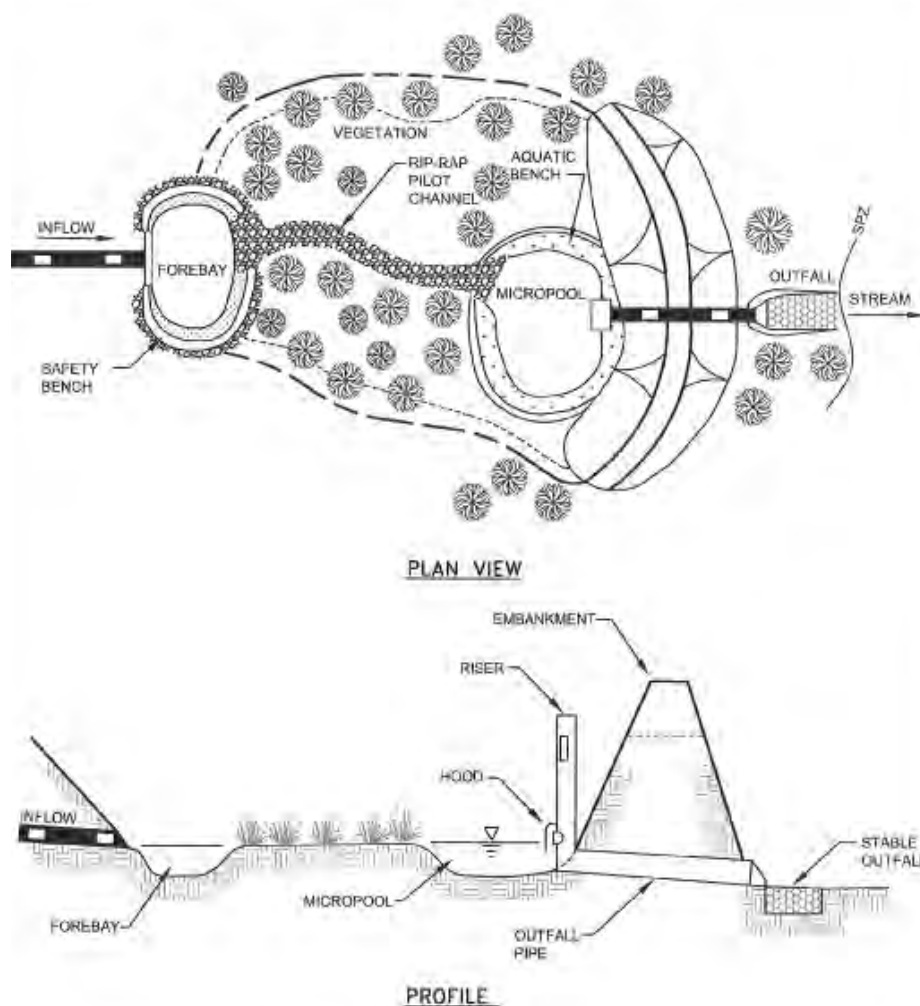


meandering low-flow channel



check dams slow water flow in swale

Example of Enhanced Dry Detention Pond



enhanced dry detention in residential neighborhood

BMPs for Sediment Removal and Velocity Reduction prior to discharge to the Streamside Buffer

| BMP | Function | Applicability | Limitations |
|-----------------------------|--------------------------------------|---|---|
| Grassed Swales | Sediment Removal | Used after velocity reduction is achieved. | Small drainage areas, less than 5 acres. |
| Sediment Forebay | Sediment Removal | Used for pretreatment rather than as a standalone BMP. | No minimum or maximum drainage area. Depths may require removal of bedrock. |
| Meandering Low Flow Channel | Sediment and other pollutant removal | Used after velocity reduction is achieved. | Requires a wider space than a linear channel. |
| Riprap Apron | Sediment Removal; Velocity Reduction | Used at the end of an outlet pipe or channel. | Can be used at most outlets where the flow speed is high. Not aesthetic. |
| Check Dam | Sediment Removal; Velocity Reduction | Used within a drainage ditch, swale, or channel. May use with steep slopes. | Should only be used in channels with a drainage area of 10 acres or less. |
| Outlet sediment traps | Sediment Removal; Velocity Reduction | Used at the end of an outlet pipe or channel | No minimum or maximum drainage area. Depths may require removal of bedrock. |
| Level Spreader | Velocity Reduction | Used at the end of an outlet pipe or channel to disperse flow uniformly across a slope. | Maximum flow of 30 cfs and maximum slope of 10%. |

Notes:

- (1) BMPs shall be selected and designed following approved technical design guidelines.
- (2) For technical and design guidelines contact the City of Fayetteville Engineering Division at (479) 575-8206.
- (3) Additional methods of achieving the above criteria may be approved by the City Engineer.
- (4) BMPs may be used in combination to achieve flow velocity reduction and sediment removal.
- (5) Plantings downstream of the flow diffusion device must be adequate to prevent erosion and shall be specified in the design plan.
- (6) Reestablishment of disturbed vegetation must be accomplished as soon as

- Vegetative cover is extremely important in controlling erosion. It performs these functions:
- Shields the soil surface from the impact of falling rain
 - Holds soil particles in place
 - Helps to maintain the soil's capacity to absorb water
 - Slows the velocity of runoff



stormwater diffusion with plant materials

practicable, but in no case longer than 14 days.

MITIGATION PRACTICES FOR APPROVED VARIANCES

Ordinance requirements:

- If the Planning Commission has granted a variance for a reduction in the width of the Streamside Protection Zones, it may require mitigation through installation of structural BMPs. Removal efficiencies cited on the Environmental Protection Agency National Menu of Stormwater Best Management Practices may be used to select suitable structural BMPs or combinations of structural BMPs. Examples of possible BMPs for consideration include wet ponds, wetlands, infiltration trenches, and bioretention. Structural BMPs selected for mitigation shall be approved by the City Engineer.

LOW IMPACT DEVELOPMENT

The use of Low Impact Development principles throughout the development is encouraged to reduce the total volume of runoff contributed by the development. Reference the UDC Chapter 179 Low Impact Development Code.